



GLOBAL INITIATIVE OF ACADEMIC NETWORKS  
(GIAN)



## Course on

# One-dimensional metal-oxide nanostructures: Recent developments in synthesis, characteristics and applications

January 28-February 8, 2019

Discipline of Metallurgy Engineering and Materials Science,  
Indian Institute of Technology Indore- 453552. INDIA.

### Overview:

The objective of this course is to provide an introduction to, and overview of, the physics of the 1D metal-oxide nanostructures. It should be suitable for undergraduate physicists and engineers who are interested in this application of semiconductor physics, and to non-specialist graduates and others who require a background in the physical principles of the 1D metal-oxide nanostructures. The focus is on the basic semiconductor physics relevant to the 1D metal-oxide nanostructures, and how these relate to the design and function of practical devices.

Modules	A: Lectures : January 28-February 8, 2019 B: Tutorials/labs : January 28-February 8, 2019
Target Audience	Executives, engineers and researchers from manufacturing, service and government organizations including R & D laboratories. • Student students at all levels (B. Tech./M. Sc./M. Tech./Ph. D) or Faculty from reputed academic institutions and technical institutions.
Fees	Participants from abroad: US \$500:00 Academic Institutions: INR 4,000 Industry/Research Organizations: INR 10,000  The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. Working lunch will be served. The participants will be provided with accommodation on payment basis.
Accommodation	You may request to <a href="mailto:hostel@iiti.ac.in">hostel@iiti.ac.in</a> for checking availability
Fee	<b>Registration Procedure</b> The registration can be done <b>Step 1:</b> The payment can be made By Demand Draft: Demand Draft should be drawn in favor of “Registrar, IIT Indore”, payable at Indore.

	<p>Or By NEFT Transfer: Registration fee can be paid through NEFT. Transfer of the amount can be done to the account number given below:  Name of the Beneficiary : Registrar, Indian Institute of Technology Indore  Name of Bank : Canara Bank  Branch Code : IIT Indore, Simrol Campus Branch  Beneficiary Account No. : 1476101027440  Bank MICR Code : 452015003  Bank IFS Code : CNRB0006223</p> <p><b>Step 2:</b> Registration: After completing the payment of registration fee, fill the application form available <a href="http://gian.iiti.ac.in/register.php">http:// gian.iiti.ac.in/register.php</a> to complete the registration. If payment is made through Demand Draft, send your Demand Draft to the following address (also email the scanned copy of the Demand Draft to <a href="mailto:drpmshirage@gmail.com">drpmshirage@gmail.com</a>)  Registration deadline: January 20, 2018</p> <p><b>Contact</b>  Dr. Parasharam M. Shirage  Associate Professor,  Head, Metallurgy Engineering and Materials Science,  IIT Indore, Khandwa road , Simrol, Indore -453552  Email– <a href="mailto:pmshirage@iiti.ac.in">pmshirage@iiti.ac.in</a>  Phone: +917324306739</p>
Registration	<p>Kindly register for course at <a href="http://gian.iiti.ac.in/register.php">http://gian.iiti.ac.in/register.php</a> and send the registered details on <a href="mailto:drpmshirage@gmail.com">drpmshirage@gmail.com</a></p>

### The Faculty



**Dr. Yuan-Ron Ma** is Professor and Head *Department of Physics* National Dong Hwa University & Dean, Office of International Affairs, National Dong Hwa University, Taiwan. He conducts research on synthesis, characterization and applications of zero-dimensional (0D) nanoparticles, one-dimensional (1D) nanostructures, and discontinuous two-dimensional (2D) thin-films of metals and metal-oxides. His recent interests include structural, electronic, electrical, electrochromic, optical and magnetic measurements for their unique properties and potential applications, such as, nanoelectronics, smart windows, light-emitting diodes (LEDs) and laser diodes (LDs), spintronics devices. He has edited about 60 manuscripts for *Scientific Reports*, and reviewed more than 250 papers for various SCI journals. His authoring SCI papers include *Physical Review Letter*, *Physical Review B*, *Crystal Growth and Design*, *Nanoscale*, *Nanotechnology*, *RSC Advances*, *Advanced Functional Materials*, *Physical Chemistry Chemical Physics*, *Journal of Materials Chemistry C*, *Scientific Reports*, and so on. The article published in *Advanced Functional Materials* (2012, 22, 3326-2270) has been cited 248 times. The sum of total citations is over 1,400, average citation per article is 15.32, and *h*-index is 22, respectively, for his citation performance. More details are available <http://nanosciencelab.blogspot.tw/>



**PARASHARAM M. SHIRAGE** is Associate professor in Metallurgy Engineering and Materials Science, Indian Insititue of Technoloyg Indore. His research interest includes next generation solar cells, gas and humidity sensors, energy storage ( battery and supercapcitors), bio-sensors, electrochemistry, thin film growth and applications, utilization of high pressure to synthesize novel materials, novel superconductors search, isotope effects, point contact spectroscopy, microwave studies,

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**DR. RUPESH S. DEVAN** is Assistant Professor in Metallurgy Engineering and Materials Science, Indian Institute of Technology Indore, India. His research interest included synthesis and characterization of metal-oxide nanostructures and polymers for engineering energy applications. He also concentrates on the synthesis of nano-hetero-architectures and core-shell nanostructures for fabrication of energy conversion/storage devices, displays, smart windows and resistive switching devices. More details are available at <https://rupesh76.wixsite.com/rupesh>

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**Tentative Lectures Schedule:**

**Course Structure**

Day & Subject	Schedule	Time	Subject
Day1 2019.01.28 Introduction	Lecture 1	10:00 ~ 11:00	Recent developments in synthesis, characteristics and applications
	Lecture 2	11:15 ~ 12:15	
	Break	12:15~ 13:00	
	Lecture 3	13:00 ~ 14:00	
Day2 2019.01.29 Synthesis I	Lecture 4	10:00 ~ 11:00	Direct physical deposition techniques
	Lecture 5	11:15 ~ 12:15	Physical vapor deposition (PVD) & Confinement growth
	Break	12:15~ 13:00	
	<b>Tutorial 1</b>	14:00 ~ 15:00	Lithographic techniques (Tutorials)
Day3 2019. 01.30 Synthesis II	Lecture 6	10:00 ~ 11:00	Direct chemical deposition techniques
	Lecture 7	11:15 ~ 12:15	Glancing angle deposition & Chemical vapor deposition (CVD)
	Break	12:15~ 13:00	
	<b>Tutorial 2</b>	14:00 ~ 15:00	Hot-filament metal-oxide vapor deposition (HFMOVD) Sol-gel technique & Solvothermal technique (Tutorials)
Day4 2019.01.31	Lecture 8	10:00 ~ 11:00	Vapor-liquid-solid (VLS) growth mechanism

Growth mechanism	Lecture 9	11:15 ~ 12:15	Vapor-solid (VS) growth mechanism
	Break	12:15~ 13:00	
	<b>Tutorial 3</b>	14:00 ~ 15:00	Solution-liquid-solid (SLS) growth mechanism (Tutorials)
Day4 2019.02.01 Anisotropic crystalline I	Lecture 10	10:00 ~ 11:00	Tungsten oxide,
	Lecture 11	11:15 ~ 12:15	Vanadium oxide,
	Break	12:15~ 13:00	
	<b>Tutorial 4</b>	14:00 ~ 15:00	Nickel oxide, Tantalum oxide, Molybdenum oxide, (Tutorials)
Day5 2019.02.04 Anisotropic crystalline II	Lecture 12	10:00 ~ 11:00	Titanium oxide
	Lecture 13	11:15 ~ 12:15	Niobium oxide
	Lecture 14	12:15~ 13:15	Zinc oxide
	Break	13:15 ~ 14:15	
Day6 2019.02.05 Applications I	Lecture 15	10:00 ~ 11:00	Bismuth oxide
	Lecture 16	11:15 ~ 12:15	Tin oxide
	Break	12:15~ 13:00	
	<b>Tutorial 5</b>	14:00 ~ 15:00	Gas sensors (Tutorials)
Day7 2019.02.06 Applications II	Lecture 17	10:00 ~ 11:00	Electrochromic devices
	Lecture 18	11:15 ~ 12:15	Light emitting diodes
	Lecture 19	12:15~ 13:15	Field emitters
	Break	13:15 ~ 14:15	
Day8 2019.02.07 Applications III	Lecture 20	10:00 ~ 11:00	Supercapacitors and Nanoelectronics
	<b>Tutorials 6 &amp; 7</b>	11:30- 12:30	Supercapacitors and Nanogenerators
		14:00 -16:00	<b>Tutorials</b>
Day 9 2019.02.08	Examination	10:00 ~ 12:00	<b>Examination</b>

**Lectures: 20 hrs**

**Tutorials: 7 hrs**